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Mukai

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Makoto SASAKI

Serial No.: 09/532,892 Group Art Unit: 2815

Filed: March 22, 2000 Examiner: P. Brock, II

For: SEMICONDUCTOR DEVICE WITH COPPER FUSE SECTION

Honorable Commissioner of Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination on the merits and calculation of the filing fee, please amend the above-identified application as follows:

IN THE CLAIMS:

Please cancel claims 8-14 without prejudice or disclaimer.

Please amend claim 1 as follows:

SUB C1 B1

1. (Twice Amended) A semiconductor memory device, including a copper fuse section that is oxidized by a laser beam in an oxidizing environment, comprising:

a dielectric film including a first film section formed on a substrate, a second film section formed on said first film section, and a third film section formed over said second film section;

a wiring line structure, including:

a first and a second wiring line, each of said first and second wiring lines formed directly upon said second film section of said dielectric film without an intervening film therebetween and extending in an opposite direction, and

said copper fuse section formed on said first film section of said dielectric film, an end of said copper fuse section being connected to said first wiring line without an intervening film therebetween and another end of said copper fuse section being connected to said second wiring line without an intervening film therebetween; and

C1 B1

an opening formed in said third and second film sections of said dielectric film and between said first and second wiring lines, wherein said opening provides access to said laser beam to oxidize said copper fuse section in said oxidizing environment.

Please add claims 17-25 as follows:

SUB C3

--17. A semiconductor device including a copper fuse, said copper fuse being programmed to a high resistance state by oxidation, wherein said high resistance state results from a cross section of said copper fuse being oxidized to copper oxide.

B2

18. The semiconductor device according to claim 17, wherein said copper fuse is formed on a dielectric film that has a thermal endurance of 350° C or greater.

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19. The semiconductor device according to claim 17, wherein said copper fuse is formed on a dielectric film that has a relative dielectric equal to or less than 4.

SUB C4

20. A semiconductor device that includes a copper fuse, comprising:

a dielectric film including a first film section formed over a substrate, a second film section formed on said first film section, and a third film section formed on said second film section;

a first wiring line and a second wiring line, each of said first wiring line and said second wiring line being formed on said second film section of said dielectric film;

said copper fuse formed on said first film section of said dielectric film, an end of said copper fuse being connected to said first wiring line and another end of said copper fuse being connected to said second wiring line, and said copper fuse being programmed to a high resistance state by oxidation; and

an opening formed in said third and second film sections of said dielectric film and between said first wiring line and said second wiring line,

wherein said high resistance state results from a cross section of said copper fuse being oxidized to copper oxide and said cross section is located in said opening.

21. The semiconductor device according to claim 20, wherein said first film section of said dielectric film has a thermal endurance of 350° C or greater.

22. The semiconductor device according to claim 20, wherein said first film section of said dielectric film has a relative dielectric constant equal to or less than 4.

23. The semiconductor device according to claim 20, wherein at least one of said first wiring line and said second wiring line includes copper.

24. The semiconductor device according to claim 20, further comprising a third wiring line formed on said first film section of said dielectric film.

25. The semiconductor device according to claim17, wherein said cross section includes at least a portion of said cross section.--

REMARKS

Claims 1-7, and 15-25 are pending in the application. By this Preliminary Amendment, claim 1 is amended. No new matter is added to amended claim 1. Claim 1 is amended to more fully describe the claimed invention.